

DRIED PLUM CULTIVAR DEVELOPMENT AND EVALUATION

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INTRODUCTION

California is the world leader in dried plum production, but is almost entirely dependent on the use of a single cultivar, the Improved French prune. This monoclonal situation lends itself to vulnerability to widespread disease, pest outbreaks and wide yield variations caused by variable weather conditions that can negatively or positively effect fruit set and/or fruit retention throughout the state. In addition to the risks of a monoculture system, the entire industry harvests and dehydrates the crop within a few weeks since the entire crop has a similar developmental pattern. The development of new, acceptable or superior, dried plum cultivars will increase the efficiency of California dried plum production and give some protection against the risks involved with a monoculture. The California dried plum industry is also facing increasing marketing competition from other regions of the world and must seek ways to reduce production costs to stay competitive. Thus the industry would also benefit from the development of new dried plum varieties that have cost saving characteristics such as improved tree structure that would require less pruning, improved fruit dry matter content that would decrease drying costs, and increased tolerance to pests and diseases. Introducing new dried plums that differ in flavor or color could also promote a broadening of the consumer base.

The Dried Plum (*Prunus domestica*) Development and Evaluation program has enlarged its germplasm and bred new generations of progeny through traditional horticultural breeding methods since its conception in 1985. Through twenty-seven years of evaluation and selection, the breeding program has increased the occurrence of desired characteristics in the germplasm. To insure that the germplasm and new cultivars are well adapted to California's dry, hot climate, the program evaluates elite selections at two locations; the UC Wolfskill Experimental Orchards, near Winters, in the north; and the Kearney Ag Center, near Parlier, in the southern San Joaquin Valley. The breeding program has matured and is now entering what we anticipate to be a very productive period for producing potential new cultivars that are specifically adapted for California growing conditions and markets.

In recent years we have increased our focus on tree and fruit characteristics that will be particularly helpful in reducing grower costs while improving the dried fruit products. To this end we have put a greater emphasis on evaluating tree structure, fresh and dried fruit sugar constituents that may influence dry-away ratios and ease of dried fruit handling.

In several years during the last decade dried plum orchard yields have been down because of poor weather conditions for fruit set during the bloom period. We believe that this has been largely due to high temperatures during bloom. Since the California industry is composed of one cultivar, the whole statewide industry suffered with poor crops during those years of heat during bloom. Because the critical time of pollination is so important we have increased the evaluation of our seedlings and selections for differences in bloom date. In doing so, new cultivars can potentially introduce greater diversity of bloom timing so that the entire Californian crop will not

be dependent on the same set of weather conditions during periods critical for fruit set and retention.

PROGRAM OBJECTIVES

Objectives:

- 1.) To develop new dried plum varieties, through traditional horticultural breeding methods, with the following characteristics:
 - Tree characteristics that reduce labor costs involved in producing dried plums.
 - Increased fruit quality and fruit characteristics that increase efficiency and quality of drying and processing.
 - Earlier or later bloom dates and tolerance to high temperatures during bloom.
 - Earlier/later fruit maturity dates than “Improved French” dried plum..
 - Increased tolerance/resistance to disease.
 - New specialty traits; with the dried product being equal or improved in quality to “Improved French”, but different in taste and/or color.
- 2.) Test and evaluate advanced selections resulting from the current breeding program at UC and grower locations in the Sacramento and San Joaquin Valleys.
- 3.) Cooperate in the FasTrack SCRI research project lead by Dr. Ralph Scorza (USDA Kearneysville WV) to increase breeding efficiency for dried plums.

PROCEDURES

Breeding methods, pollination and seedling cultivation, and selection evaluation have not been substantially modified for several years. They were described in detail in the Dried Plum Cultivar Development and Evaluation annual report in the 2004 Prune Research Reports published by the California Dried Plum Board. The following is a brief description of our testing and evaluation procedures as a reference for the Results section of this report.

Levels of Testing

Field testing and evaluation of dried plum selections developed within this program are being carried out at four levels.

Level 1 testing involves evaluations made in the seedling blocks located at UC Davis. The initial fruit evaluation is made on the original self-rooted seedlings in the high density seedling blocks. Fresh and dried fruit characteristics are evaluated at this level of testing. If a positive evaluation results, the seedling becomes a “selection” and is then considered for re-propagation in dried plum selection blocks located at the Kearney Research and Extension Center in Parlier, CA and at the Wolfskill Experimental Orchards in Winters, CA.

Level 2 testing occurs in the selection blocks at Kearney and Wolfskill. Depending on the perceived potential of the individual selection, two to four trees of any one selection are established on commercial rootstocks. This level of testing is concerned with fruit characteristics and tree growth habit. Variations in fruit size, tree vigor, maturity date and other characteristics may, and often do, occur when the selection is moved onto a rootstock from the original seedling. Individual selections are evaluated using specific criteria that match the goals of the program. These criteria must be achieved before advancing to Level 3. Therefore there are multiple types of Level 2 trees: those that have yet to fruit in the selection block; others that are still being evaluated and have the potential to advance to grower's orchards and others that are kept for germplasm and breeding purposes.

Level 3 testing involves the establishment of advanced selections in grower orchards in various locations. Testing at this level is still somewhat preliminary since these plantings are the first instance in which selections are established in varying soil types and in varying climatic regions. Again, depending on the perceived value of the individual item, two to one hundred trees of any one selection are established at any one location. Level 3 grower tests are established in counties throughout the Sacramento and San Joaquin Valleys where dried plums are a commercial crop. In recent years we have increased our selectivity of trees advancing to Level 3 status. The specificity of criteria for new advanced selections is so narrow, we have chosen to not promote trees to this level until we have confidence in the desirability of their structure, production and process-ability.

Level 4 testing involves the planting of extensive test acreage, usually of a single targeted selection. The size of these Level 4 plantings depends on the apparent potential of the individual selection and the level of risk that the cooperating grower is willing to assume. Ideally these plantings would be as large as 20-40 acres. At this level, thorough tests of process-ability and acceptability in the commercial market are conducted. These tests are designed to gauge the commercial value of the item prior to formal release. The promotion of items to Level 4 is based on the industry's input and feedback. When the California Dried Plum Board a selection is ready for such extensive testing the University and breeders will develop a research agreement with the Dried Plum Board and a grower to allow a test to be planted. Release of the selection for full-scale commercial production will be delayed until a Dried Plum Board decision is made concerning the suitability and desirability of the selection for further commercial production.

Dried Plum/Prune Testing Group

The Plum/Prune Testing Group incorporates the participation of growers and processors to evaluate and test dried plum selections for their potential as new cultivars before patenting and public release. For the first twenty years of this project the University of California conducted the dried plum/prune breeding and evaluation program with joint support from the Department of Plant Sciences (previously the Department of Pomology) and the California Dried Plum Board. This program was originally initiated at the request of the California Dried Plum Board with the primary goal of developing cultivars that would extend the harvest season with quality characteristics that equal or exceed those of the California standard, Improved French. This project made substantial progress toward that goal with the development of Sutter and Muir Beauty, which have the potential to be harvested up to two weeks earlier than Improved French.

The process used in the final evaluation and release of Sutter and Muir Beauty was based on a traditional model that public breeding programs have used for the past 50 years. After identifying selections that appeared promising and evaluating those selections at the University and in limited grower trials, the selections deemed suitable for public use were patented and released, assuming that there would be enough interest from growers, packers and nurseries to promote the cultivars and allow them to receive the true test of time in the commercial marketplace. While this model is still valid in a general sense, it is now apparent that it may not be the most efficient or effective model for the evaluation and release of dried plum cultivars in the future.

Therefore we have developed a different strategy for the final evaluation and future release of dried plum/prune cultivars derived from the breeding program. In 2005 we organized a Dried Plum/Prune Testing Group that will help develop a better process for the release of new cultivars and participate in carrying out that strategy.

The group has met two times a year since 2005 to develop testing strategies and evaluate advanced plum/prune selections. Participation in the group involves two general meetings a year, one in the summer just before prune harvest to look at fresh fruit and tree characteristics and a second time in the fall or winter, for the evaluation and discussion of dried product characteristics. The objective is to benefit from greater grower and processor input on individual selections as well as increase grower test plot participation so that by the time a selection is identified for release, the industry is well informed about the cultivar and comfortable about committing to plant, process and sell the cultivar commercially.

The advantage for participation in this testing group is that growers and processors gain first-hand information on all new selections in the program on which to base future planting/marketing strategies, participate in test plantings as well as have early access to new cultivars slated for release, and help direct the breeding and evaluation program to address germplasm-based issues in the future.

The Dried Plum/Prune Testing Group is currently the primary group that will make recommendations to the California Dried Plum Board for initiating large-scale Level 4 commercial testing of new selections.

RESULTS

Bloom Data

The importance of bloom data has grown in the last decade because of the changing weather patterns that California has experienced. It has become more common to have heat spells in March that often have temperatures near 80°F. If high temperatures occur when Improved French is blooming the biological mechanisms for successful pollination and fertilization are negatively affected. The result has been low fruit set across the state. Variation for time of bloom is naturally found within the breeding programs germplasm. Introducing new cultivars to

the California dried plum industry that have bloom times earlier or later than Improved French could reduce the risk of having the entire crop reliant on good weather conditions occurring during French bloom. This year bloom unusually extended, but successful for most prune growing areas.

Bloom data, including date of full bloom (90% flowers open), amount of bloom, and the first and final day of bloom has been recorded for all the Level 2-4 selections since 2003. Table 1 shows the average number of days each top selection blooms before or after Improved French's full bloom. Because bloom time varies from year to year depending on annual chilling accumulation and spring time temperatures the table also shows the range of number of days over the years each top selection blooms before or after Improved French's full bloom. Because this was an unusually long bloom, average bloom length for each variety was also included. Historically, bloom length varies with each cultivar, but usually lasts around a week, the 2012 data shows two or three times that. This resulted in varying fruitlet ages on a single tree as well as uneven fruit set. As shown in contrast with the historical data, 2012 was a unique spring.

Table 1. Bloom data at the Winters selection orchard for the 2012 top selections.

Cultivar	Full Bloom Date (90%)	Days in Bloom 2012	Average Days in Bloom	Days from French 2012	Average Days from French
Imp. French	April 10	14	8	+/-2	+/-2
F11S-38	March 12	14	9	-29	-12
G3N-16	March 13	16	10	-28	-15
G36S- 57	March 29	24	7	-12	-12
Tulare Giant	March 29	19	8	-12	-8
F11S- 65	March 21	12	9	-9	-6
H7N- 71	April 2	19	--	-8	-6
G16N-19	April 6	23	10	-4	-3
G5N- 35	April 11	16	11	1	-1

Level 4 Testing

Despite the many promising selections in our program, more research needs to be gathered on those individuals before Level 4 testing can be initiated. Once there are more years of analysis and more things known about these selections, the industry can make an informed decision about testing multiple acres and the promotion to Level 4.

Level 3 Testing

Level 3 testing is the evaluation of selections that are being grown and tested in grower's orchards. We have chosen to only promote selections to Level 3 status when the tree has proven to meet specific criteria over multiple years. This has limited the number of active Level 3 selections, we only plant trees in grower's orchards when we are fairly confident in their fruit and tree quality. The top selections that are now at Level 3 testing are F11S- 38, D6N-103, and F13S-46. Items D6N- 103 and F13S- 46 are still being grown by cooperators and still being monitored for use in niche markets despite that they have been deemed unusable for the main commercial market. Two selections are ready Level 3 promotion are G5N- 35 and G16N- 19. G16N-19 specifically was selected by growers in the December tasting. They showed enthusiasm for further testing of this tree. Harvest data for the Level 3 selections are shown in Table 2.

Table 2. Level 3 selection performance for 2012 at university selection blocks. 'Days from French' refers to the difference between the French harvest date and the harvest date of the selection at the same location. The harvest date listed is specific for locations where samples were collected.

Selection	Location	Bloom days from French	Harvest days from French	Pressure	Sugar^o Brix)	Dried Count / lbs	Dry ratio	Comments
F11S-38	Winters	-29	-30	4.8	33.0	55.7	2.2	Will dry on tree, self pollinating. Low dry away ratio
F13S- 46*	Kearney	-5	-10	2.9	27.5	31.1	2.7	Yellow fruit, not self pollinating. Whole natural.
D6N-103*	Winters	-2	-3	4.0	26.0	64.4	3.2	Great tasting, great looking fresh or dried. Not self compatible
G5N- 35	Kearney	2	1	4.1	24.1	64.6	3.1	Small statured tree. Fruit very similar to French
G16N- 19	Kearney	1	9	4.5	25.2	38.9	2.8	Round great tasting fruit. Pollination compatibility to be tested 2013

*Selections candidates for niche market operations, not candidates for commercial mainstream production.

F11S- 38 is a self-pollinating, good statured tree with round yellow fruit. It bloomed very early in 2012, and historically it blooms 1-2 weeks before Improved French. The tree harvests about 3-4 weeks before Improved French. This tree is unique in the fact that most of the fruit will partially dry on the tree before being removed. This gives the fruit a low dry away ratio ranging from 2-2.5. This characteristic could save growers in transportation costs and in drying costs. This is due to the fact that there is less water to be removed from the fruit upon dehydrating, and since the fruit is partially dried upon transport, more fruit can be transported at one time.

Additionally, there is a possibility less drying time would be needed per fruit, more testing is needed to confirm this. This tree is only located at the Winters selection block, and that tree was harvested 3 times in 2012. The first two dehydrations were conducted at the UCD campus and the last harvest was picked on August 6th and dried at the Sunsweet dryer in Winters, CA, when it opened in mid-August. These harvests were on July 21st, July 30th and August 6th the dry away ratios were 2.4, 2.2 and 1.9 respectively. The pressures were 5.6, 4.8 and 3.2 PSI and the sugars were 31.6, 33.0 and 33.6 degrees brix respectively. The average weights were 24, 21 & 19 grams per fruit. To summarize this harvest, as the fruit matured, the weights, pressures and dry away ratios decreased while the sugars increased. Extra trees have been propagated for further testing so the harvest time, drying time, tree structure and ability to be mechanically harvested can be thoroughly evaluated over the next few years. Another unique quality of this selection is the toughness of the fruit without compromising good taste. This tough skin and flesh looks to be sturdy enough to withstand the challenge of mechanical harvesting and processing when the fruit has partially dried on the tree. Of course these qualities will be thoroughly tested in the next few years.

F13S-46 bears an attractive, yellow fruit that has a shape similar to Improved French. It harvests about 2 weeks before French. F13S-46 blooms about 4 days before Improved French but its flowers are not self-compatible, and it's compatibility with Improved French pollen is still being tested. F13S-46 has a medium to small sized pit. It dries to make a very sweet, pleasant tasting prune and has received very high ratings in our fruit tasting events. Preliminary pitting tests by a commercial processor were successful, but would likely be marketed most successfully as a whole natural product.

D6N-103 is a high sugar prune that looks very similar to French in shape and color. The dried fruit is a shiny dark brown appearance with a meaty flesh. It is a larger prune than French and may do very well in a specialty market. It is versatile in the fact that it makes a great fresh pack plum as well. It would be ripe for fresh picking a week or two after Tulare Giant. D6N-103 is not self-compatible and requires Improved French as a pollinizer. This cultivar has a tendency to have around 10% split pits. This will likely prevent it from moving any further in the dried plum program. The future of this selection depends on grower input, fresh pack growers are positive about it, but hesitate because of market conditions and the split pit issue. With correct thinning, this selection could easily fit into the fresh or the dried commercial market. Its sugar profile is similar to Improved French.

G5N- 35 is a small statured tree that has fruit very similar to Improved French. In 2011 it bloomed 4 days before Improved French whereas in 2012 it had full bloom one day after Improved French. Bloom timing and pollination compatibility will be further evaluated in 2013. In the selection blocks it is top grafted on Marianna 2624 and M40 rootstocks, this fall it was budded onto 29C to insure compatibility and to more thoroughly evaluate tree structure. It has a pleasant dry appearance and tough skin. It is a good example of a tree that would need significantly less pruning than an Improved French tree. The fruit is purple, and French shaped, it harvests the same time or a few days after Improved French. Unlike Improved French, it had no heat related damage at Kearney and had a pressure of 4.1 PSI with a sugar of 24.1 degrees brix.

G16N- 19 is a nice fresh light purple colored fruit that dries around a 3 dry away ratio. It has a normal to vigorous growth habit, and since it can produce heavily on first year growth it is not a good candidate for long pruning. It harvests late, about 7-14 days after Improved French. It was harvested on September 7th at Kearney with a pressure of 4.5 and a sugar of 25.2. In September, at Winters, it did not soften very quickly, so its ability to stay firm will be further evaluated next year, and in doing so, we will test if harvesting at a softer flesh pressure will further reduce the dry away ratio. It usually blooms 4-3 days before Improved French, and self pollination compatibility will be tested in 2013. This selection is unique in the fact that it could spread harvest time of dried plums to after Improved French.

Level 2 Testing

Level 2 testing evaluates a selection after it has been promoted from the Davis seedling blocks to the advanced selection blocks at Kearney and Wolfskill. Once the tree has matured and has started growing fruit, the whole tree and fruit characteristics are evaluated. Table 3 shows the harvest data of the top selections this year. Some of our newest Level 2 trees are young grafts have yet to produce fruit there are approximately 25 grafted selections at Kearney and Winters that we anticipate seeing fruit on next year.

Table 3. 2012 Harvest data for advanced selections in Level 2 testing. ‘Days from French’ refers to the difference between French harvest date and the harvest date of the selection at the same location. Harvest date listed is specific for locations where samples were collected.

Selection	Location	Bloom Days from French	Harvest, Days from French	Pressure	Sugar (°Brix)	Dried Ct/lb	Dry Ratio	Comments
F11N-65	Kearney	-8	-24	4.4	21.9	45.2	2.8	Smaller size, green
G39N- 57	Winters	-16	-17	3.9	27.3	42.5	2.7	Meaty dried, small pit
G39N- 34	Winters	-12	-17	5	24.0	41.8	2.5	Great dried characteristics
G37S- 72	Winters	-16	-17	6.2	26.9	49.3	2.6	Good flesh, 1 st year of evaluation
G3N- 16	Winters	-28	-10	6.8	26.4	44.4	2.7	Great dried taste
G40N- 34	Winters	-16	0	5.6	27.2	42.2	2.8	Thick skin and flesh, fruit stays firm
G36S- 57	Kearney	-8	+3	5.2	27.3	34.9	2.8	Thick flesh, great dried taste
H7N- 71	Winters	-8	+10	6.1	22.6	43.3	2.9	Good flesh, 1 st year of evaluation

F11S- 65 is a good quality dried product. It has a green round fresh fruit with a small pit. It has had a medium to large crop the last two years and shows great promise. During the growing season, the fruit is fairly astringent until the last week or two before harvest (20-25 days before Improved French). It blooms about a week before Improved French and needs to be tested for its self pollination capabilities.

G39N- 57 is a new item in the selection block, its parents are Muir Beauty and D2N-76 (top item from 2007-2010). It looks to have inherited the excellent taste and high sucrose of Muir Beauty and the good drying qualities and high sorbitol of D2N-76. It harvests early, about 2 weeks before Improved French. It has an extremely small pit and thick meaty flesh. It had a low dry away ratio of 2.7 when harvested at Winters with a pressure of 3.9 PSI. It was one of the top 3 items selected in our December tasting by industry members. Next year we will evaluate the tree for uneven ripening and heat sensitivity.

G37S- 72 is a tree whose parents were chosen for their great structure and ability for the fruit to dry on the tree. Its genetic history and 2012 evaluation make it a very promising tree. It had a dry away ratio of 2.6 at Winters and looked to have great dried flesh characteristics.

G3N-16 was a top item last year and was selected because of its durable skin and high sorbitol levels. It is self-pollinating and the tree has a great spur bearing structure that could reduce pruning compared to Improved French. The dried fruit characteristics are very appealing and is a good example of what this program is looking for in regards to process-ability. . The dry away ratio this year was 2.7, but despite this good mark, the fresh fruit contains ample amounts of free juice. This will likely be a problem for shipping in bins during harvest. This will continue to be evaluated in 2013.

G40N- 34 is a promising cultivar with high sucrose whose parents are Muir Beauty and D2N-76. Has excellent dried qualities with thick substantial flesh. It was one of the top items selected by the industry in our December tasting. When maturing, it did not soften during harvest. It had a dry away of 2.7 on August 13th and a dry away of 2.8 on August 30th with a pressure of 6.1 & 5.6 respectively. It is a yellow color when fresh, but dries to a deep mahogany color when dried. Its ability to stay firm will be further evaluated in 2013 as well as its crop size.

G36S- 57 is a sibling of the above mentioned G37S- 72. It is a larger fruit, with great dried qualities. It had a dry away ratio of 2.8 on August 21st and the same dry away of 2.8 on August 29th with sugars of 25.8 and 27.3 respectively. It harvests a few days after Improved French, and the self pollination compatibility is yet to be determined.

H7N- 71 is the first selection to be selected out of our "H" seedling block. It is a yellow colored fruit with usually thick flesh. This is its first year of evaluation, but looks very promising with

good looking dried characteristics and an adequate dry away ratio of 2.9. We still have much to learn about this fruit.

Shown in Table 4, there are three Level 2 selections that could be great items for the fresh market. They vary in color, shape, flavor and harvest date. Growers interested in unique fresh items are welcome to test these trees in their own orchards. G25N- 16 is interesting because it does not seem soften, and is a yellow green color. F9N-33 is a beautiful deep purple, almost blue plum. 2012 was its first year of evaluation; in 2013 it will be thinned for the fresh market and further evaluated.

Table 4. Harvest data for fresh market items. Most trees were not adequately thinned for accurate fresh fruit size evaluations.

Item	Location	Skin Color	Shape	Date	Grams/fruit	PSI	Degree Brix	Comments
Tulare Giant	Winters	purple	Oval	16-Jul	46.4	5.5	22.3	Industry standard
	Kearney	light purple	Oval	12-Jul	50.7	7.3	15.4	Industry standard
G40N-28	Winters	light purple	Long French	10-Jul	49.1	5.8	21.9	Not thinned for Fresh
	Kearney	light purple	Long French	12-Jul	40.2	6.0	22.6	Not thinned for Fresh
F9N-33	Winters	dark purple	Large French	30-Jul	50.2	7.6	21.7	Not thinned for Fresh
	Kearney	dark purple	Large French	26-Jul	57.1	9.4	23.7	Not thinned for Fresh
G25N-16	Winters	green	Oval	6-Aug	32.6	10.36	20.3	Not thinned for Fresh
	Kearney	green	Oval	29-Aug	40.8	7.7	22.6	Not thinned for Fresh

Level 1 Testing

Level 1 testing evaluates the young seedling selections at Davis with fruit quality being the primary selection criteria at this level. The seedlings set nice, medium-sized crops this year with little need for thinning. Around 192 samples were taken from the Level 1 seedling block for fresh evaluations, of those around 115 samples were dried and processed for the rehydrated in house tasting evaluation in October, of those 45 were chosen to be grafted into the selection blocks. Table 5 shows the harvest data of the top 31 seedlings evaluated at Level 1. The selections listed in Table 5 will be grafted into both selection orchards for further potential cultivar evaluation. Table 6 describes the 14 promising germplasm seedlings that were selected from the seedling block for breeding. These germplasm selections all contain fruit traits that are comparable or superior to the breeding germplasm currently used in Winters and Kearney.

Table 5. 2012: Harvest data for advanced selections in Level 1 testing at Davis.

Harvest date	Seedling location	Harvest date from French	CROP SIZE	Fresh skin color	PSI	Degrees Brix	Count/lb	Dry ratio
25-Jul	H8N- 74	-42	low	light purple	3.9	26.6	72.4	2.9
10-Aug	G30N- 24	-27	low	green	3.5	24.3	76.8	2.8
10-Aug	G35S- 40	-27	medium	deep purple	3.5	23.6	80.5	3.1
10-Aug	G37N- 17	-27	low	purple	6.7	23.3	64.9	3
10-Aug	G37S- 45	-27	medium	deep purple	6.3	24.5	61.1	2.8
10-Aug	H5N- 14	-27	low	yellow	6.3	29.5	50.8	2.3
10-Aug	H5N- 83	-27	medium	deep purple	3.9	25	94.6	3.1
15-Aug	H13S- 65	-22	medium	deep purple	3	25.6	51.3	2.9
15-Aug	H16N- 83	-22	medium	deep purple	3.3	22.3	51	3.1
15-Aug	H9N- 33	-22	medium	deep purple	3.5	22.9	69.6	3
17-Aug	G38S- 72	-20	medium	red	2.4	22.2	66.7	3.3
17-Aug	G41N- 27	-20	medium	deep purple	2.8	25.2	67.4	3
24-Aug	G43N- 59	-14	low	green	4	22.5	64	3.3
24-Aug	G43S- 15	-14	low	purple	6.2	23.4	51.7	3
24-Aug	G47S- 4	-14	medium	deep purple	4.8	23.1	56.9	3.1
24-Aug	H17S- 23	-13	medium	deep purple	6.8	21.8	48.1	3
24-Aug	H19S- 47	-13	medium	deep purple	3.4	23.5	69.3	3.3
24-Aug	H20S- 58	-13	medium	yellow	4.8	27.3	37.8	2.8
28-Aug	H10N- 38	-9	low	light purple	4.3	24.6	53.9	3.1
28-Aug	H10N- 88	-9	low	purple	5.2	28.3	46.6	2.5
6-Sep	G19S- 31	1	medium	deep purple	4.3	25.6	52.1	3
6-Sep	G26N- 8	1	medium	deep purple	8.5	25.2	42.2	2.9
6-Sep	G27N- 31	1	medium	blue	4.1	25.1	56.3	3
13-Sep	H11N- 38	6	medium	red	4.4	26.3	66.2	2.9
13-Sep	H13S- 58	6	high	blue	1.6	24.3	63.6	2.6
13-Sep	H17S- 2	6	low	blue	7.9	27.5	46.2	2.5
13-Sep	H21S- 81	6	medium	green	4	27	67.2	2.8
13-Sep	H6S- 3	6	low	deep purple	2.7	23.3	69.8	3
13-Sep	H7S- 61	6	medium	purple	3.7	26.8	53.2	2.8
13-Sep	H8S- 55	6	medium	blue	5.3	25.9	46.7	2.7
13-Sep	H8S- 75	6	medium	deep purple	5.5	27.2	52.3	2.7

Table 6. Level 1 seedlings with premium traits for germplasm improvement.

Harvest date	Seedling location	Harvest from French	Crop Size	Skin Color	PSI	Degrees Brix	Count/lb	Dry ratio
25-Jul	H19N-13	-42	low	blue	3.3	21.3	71.0	3.3
3-Aug	H19S- 64	-34	low	light purple	4.7	22.1	60.0	3.3
3-Aug	G35N- 13	-34	med/low	blue	2.7	21.7	62.6	2.9
3-Aug	G36N- 50	-34	low	deep purple	3.6	30.3	53.4	2.5
15-Aug	H13S- 71	-22	med/low	yellow	2.5	25.6	48.6	3.2
17-Aug	G41S- 11	-20	med/low	deep purple	3.2	25.2	66.5	3.3
24-Aug	G42N- 58	-14	medium	green	2.9	25.0	58.2	3.2
24-Aug	G37S- 21	-14	medium	deep purple	4.5	22.6	72.5	3.3
24-Aug	H8S- 35	-14	low	yellow	3.5	26.6	42.2	2.7
28-Aug	H10S- 5	-9	med/low	blue	2.2	31.6	43.9	2.5
28-Aug	H11S- 37	-9	low	blue	7.0	30.6	34.3	2.4
6-Sep	G18S- 24	-1	med/low	deep purple	4.4	32.3	61.3	2.1
13-Sep	H6N- 94	6	med/low	deep purple	9.6	30.7	48.8	2.2
13-Sep	H6N-92	6	low	deep purple	5.8	21.0	55.1	3.4

Levels Summary

In 2011 the program was challenged to aggressively pursue reducing grower input costs by reducing the dry away ratio and reducing the costs of pruning through a new cultivar. This program has risen to the challenge by having all of our top Level 2 and Level 3 items have a dry away ratio of less than 3.0. In doing this, the program has bred new potential cultivars that could save California growers money by reducing the cost of dehydration. The Level 3 item F11S- 38 is an excellent example of a selection that could reduce the cost of drying. In regards to cost savings through pruning less, the Level 3 item G5N- 35 and Level 2 item G3N-16 are great examples of trees that could do just that.

Program Inventory

All the seedling blocks are located in the UC Davis campus research orchards. In the summer of 2012, over 1,000 seedling trees were discarded after evaluation of the seedlings showed negative fruit or tree characteristics. Due to a decrease in funding, there was no money allocated for making controlled crosses in Spring 2011. But despite this, there were a few seeds collected from a limited amount of controlled pollinations and open pollinated seeds.. The seeds were germinated in winter 2012 , and grown over the summer in pots at Duarte Nursery. These young

trees were planted in October 2012, into our seedling blocks at Davis. This added around 240 new seedlings to the 'I' block (Table 7).

The inventories of selections at each level of testing were re-inventoried and are shown in Table 8. The numbers in this table represent the number of unique selections and not the number of trees. The "breeding population" category was separated into two categories, breeding and germplasm. The breeding trees are actively being used for breeding whereas the germplasm items are old selections and cultivars collected from other programs that have negative characteristics that prevent them from being used in breeding. There is value in preserving in our germplasm trees to keep the species-wide germplasm diversified, They may someday be important parents for future generations.

Table 7. Seedling block inventories for 2012 located in the Davis UC research orchards.

Block	Acres	Year Planted	Seedlings Planted	Seedlings Remaining	Advanced Selections
G	7	2001-2005	6,756	962	77
H	4	2005- 2008	4,083	3,041	41
I	3	2008-cont.	2,656*	2,656	
Seeds		2013		(1471) [♦]	
Totals	14		13,495	6,659 ^Δ	118

*includes October 2012 planting

[♦]number of seeds in stratification for 2013 planting

^Δnot including seeds

Table 8. Number of unique selections in the dried plum program and their level of testing including the breeding and germplasm population.

Level of Testing	Number of Items	Number of new 2011 additions
Level 1	6,659	241 (~ 1,471 seeds)
Level 2	62	31
Level 3 & 4	5	2
Fresh Items	11	2
Breeding Items	48	14
Germplasm Items	118	10

Disease Screening

This year, cool spring weather promoted some disease pressure. No statistical data was collected on brown rot. We did see significant brown rot in some of the families in the seedling block. Those individuals were rogued from the program and certain parents will not be used in the future due to excessive brown rot sensitivities of the progeny. There were very few incidences of scab in our orchards this year, nonetheless, a few selections were evaluated for scab. If an item showed either scab or brown rot it was noted and the item was marked as more susceptible than the general population. Any genotypes documented as being more sensitive to scab than Improved French were discarded.

Sugar Testing

Sugar analysis is continuing with the program's top breeding selections. Four types of sugar and sugar alcohol were analyzed: glucose, fructose, sucrose and sorbitol. Sucrose is composed of one glucose and one fructose molecule. Sorbitol is a sugar alcohol that acts as a preservative in the dried fruit, and has significant positive dietary attributes. We were surprised by the large differences in fruit sugar profiles between some genotypes and the sugar percentages do indeed look to change after drying and processing. Overall we observed glucose and fructose increasing due to sucrose degrading in the drying process. The sucrose hydrolyzed and split into glucose and fructose. There was less of a consistent change with sorbitol. There was no obvious correlation seen between the inability of the fruit to be processed and the presence of high sucrose. This is a positive result, meaning that the high levels of sucrose and our germplasm can continue to provide excellent flavor without inhibiting the fruit's ability to be processed.

Table 9. Results from the fresh juice soluble carbohydrate analysis. All individual sugar results are a percentage of the sum of sugars from (high performance liquid chromatography (HPLC testing).

Selection	Total	Glucose		Fructose		Sucrose		Sorbitol	
		% of total	SE	% of total	SE	% of total	SE	% of total	SE
Muir Beauty	14.5	26.40%	0.37%	7.20%	0.13%	42.20%	0.69%	24.30%	0.67%
F9N-21	18.7	35.00%	0.56%	11.80%	0.30%	20.20%	0.94%	33.00%	0.53%
D2N-76	16.1	34.40%	0.93%	11.40%	0.44%	23.60%	0.68%	30.70%	0.70%
D10S-8	15.6	32.60%	2.17%	12.00%	1.16%	28.30%	2.54%	27.10%	0.88%
F13N-24	15.8	24.40%	0.24%	10.50%	0.13%	30.80%	0.64%	34.20%	0.45%
FRENCH	14.1	44.10%	1.47%	16.70%	1.05%	12.80%	1.16%	26.40%	1.40%
D6N-103	14.7	44.50%	1.21%	17.40%	1.06%	12.20%	1.60%	26.00%	0.77%
BURTON	13.1	27.10%	0.55%	8.00%	0.60%	39.70%	0.90%	25.20%	0.85%
E6S-12	19.8	20.10%	0.50%	6.80%	0.18%	58.10%	1.50%	15.00%	1.62%
D13N- 53	18.1	30.50%	2.18%	11.80%	0.68%	25.70%	1.53%	32.10%	2.13%

Table 10. Results from the dried fruit soluble carbohydrate analysis. All individual sugar results are a percentage of the sum of sugars from (high performance liquid chromatography (HPLC testing)).

Selection	Total	Glucose		Fructose		Sucrose		Sorbitol	
		mean	SE	mean	SE	mean	SE	mean	SE
Muir Beauty	54.1	33.5%	0.58%	18.2%	0.33%	21.6%	0.53%	26.7%	0.85%
F9N-21	57.5	42.0%	0.96%	19.3%	0.32%	4.6%	0.71%	34.1%	0.73%
D2N- 76	54.7	41.0%	0.38%	18.5%	0.65%	6.6%	0.62%	34.0%	1.14%
D10S- 8	60.1	27.4%	0.56%	15.3%	0.33%	47.1%	1.22%	10.1%	0.40%
F13N- 24	55.2	31.0%	1.05%	19.2%	0.99%	13.1%	0.84%	36.6%	1.25%
French	51.2	48.5%	0.93%	20.8%	0.32%	3.1%	0.53%	27.6%	0.90%
D6N-103	54.9	49.4%	0.55%	23.3%	0.51%	1.8%	0.41%	25.5%	0.51%
Burton	52.4	35.9%	1.66%	18.9%	1.13%	18.6%	1.80%	26.6%	1.14%
E6S- 12	57.1	26.9%	1.15%	15.3%	0.59%	41.6%	1.07%	16.2%	0.90%
D13N- 53	54	36.7%	0.57%	21.2%	1.10%	5.7%	1.42%	36.5%	0.55%

Table 11. Results from the processed fruit soluble carbohydrate analysis. All individual sugar results are a percentage of the sum of sugars from (high performance liquid chromatography (HPLC testing)).

Selection	Total	Glucose		Fructose		Sucrose		Sorbitol	
		% of total	SE	% of total	SE	% of total	SE	% of total	SE
Muir Beauty	48.3	35.3%	1.43%	22.9%	0.33%	16.6%	1.47%	25.2%	0.54%
F9N-21	52.9	41.3%	1.14%	21.1%	0.28%	3.4%	1.01%	34.2%	0.57%
D2N- 76	48.5	41.5%	0.40%	20.8%	0.14%	4.6%	0.62%	33.2%	0.53%
D10S-8	52.4	30.6%	2.69%	19.0%	1.41%	27.3%	6.24%	23.1%	2.43%
F13N- 24	46.8	34.1%	0.29%	23.2%	0.38%	8.4%	0.56%	34.3%	0.54%
French	52	42.2%	1.27%	23.1%	0.64%	2.9%	0.16%	31.8%	0.82%
D6N- 103	49.1	49.1%	0.61%	26.4%	0.40%	0.5%	0.13%	24.0%	0.83%
Burton	44.8	36.1%	1.15%	20.9%	0.95%	16.9%	1.38%	26.1%	0.82%
E6S- 12	53.9	26.7%	0.64%	17.6%	1.11%	37.0%	2.97%	18.7%	1.73%
D13N -53	49.8	36.5%	0.42%	23.4%	0.28%	4.3%	0.19%	35.8%	0.53%

Dried Plum/Prune Testing Group Evaluations

The Dried Plum/Prune Testing Group met in August this year at the Wolfskill Experimental Orchards to discuss strategies for testing and to tour the program's orchard. The group looked at fresh fruit and tree characteristics of top selections and discussed their potential as cultivars. As in 2011, the November meeting was moved to combine with the Dried Plum Research and Workgroup meeting. This was done to help reduce travel for those located far from Davis. The workgroup evaluated our top 14 selections and the results of this tasting will be located the end of this document (Table 14). Tables 12 and 13 provide details on the fresh and dried characteristics of each of the selections chosen for taste testing.

Table 12. The characteristics of the fresh fruit of the selections shown at the Dried Plum/Prune Testing Group meeting in December 2012.

Meeting tasting #	Selection	Level of Testing	Bloom date from French	Location	Harvest Days from French	Grams / fruit	PSI	Degrees Brix	Fresh Skin Color
1	F11S- 38	3	-29	Winters	-30	21.8	4.8	33.0	yellow
4	G16N- 19	3	-4	Kearney	9	32.8	4.5	25.2	purple
6	F11S- 65	2	-9	Kearney	-24	33.3	4.4	21.9	green
8	G5N- 35	3	2	Kearney	1	19.8	4.1	24.1	light purple
5	G3N- 16	2	-26	Winters	-10	25.4	6.8	26.4	deep purple
11	G39N- 34	2	-8	Winters	-17	28.7	5	24	blue
2	H7N- 71	2	-8	Winters	10	29.5	6.1	22.6	green/yellow
9	G40N- 34	2	-16	Winters	-17	36.1	6.1	23.4	yellow
7	G39N- 57	2	-16	Winters	-17	28.5	3.9	27.3	blue
10	G36S- 57	2	-8	Kearney	3	41.7	5.2	27.3	light purple
3	FRENCH	4		Winters		26.1	5.1	26.9	purple
13	G47S- 4	1		Seedling	-14	24.1	4.8	23.1	deep purple
12	H20S- 58	1		Seedling	-13	28.1	4.8	27.3	yellow
14	H8S- 75	1		Seedling	6	24.9	5.5	27.2	deep purple

Table 13. The characteristics of the rehydrated dried fruit of the top 2012 dried plum selections shown at the Dried Plum/Prune Testing Group meeting in December 2012. (Average flavor score by Castro, DeBuse, and DeJong is on a rating scale of 1-5 with 5 being the best.)

Meeting tasting #	Selection	Count/ lb	Dry ratio	Dried Skin Color	Wrinkles	Dried Shape	Dried Pit size	Dried Pit clinging type	Flesh texture	Skin Quality	Average taste eval
1	F11S- 38	55.67	2.2	light brown	average	oval	small	free	meaty	excellent	3.33
4	G16N- 19	38.88	2.8	mahogany	average	oval	average	semi free	meaty	great	3.5
6	F11S- 65	45.15	2.8	brown	average	round /oval	average	semi cling	meaty	great	2.83
8	G5N- 35	64.63	3.1	dark brown	average	French	average	semi free	meaty	excellent	2.83
5	G3N- 16	50.2	2.7	dark brown	average	French	average	semi free	average	excellent	3.5
11	G39N- 34	41.82	2.5	dark brown	average	French	average	semi free	meaty	excellent	3
2	H7N- 71	43.3	2.9	brown	average	French	average	semi free	meaty	great	3.33
9	G40N- 34	35.6	2.7	dark brown	average	oval	small	free	average	great	3
7	G39N- 57	42.5	2.7	brown	average	round /oval	small	semi free	average	great	3.33
10	G36S- 57	34.94	2.8	dark brown	average	Sutter	average	semi free	meaty	great	3.5
3	FRENCH	50.81	2.7	dark brown	average	French	average	semi cling	average	excellent	3
13	G47S- 4	56.94	3.1	dark brown	average	French	small	free	meaty	excellent	3
12	H20S- 58	37.84	2.8	RED	average	round	average	semi free	average	great	4.17
14	H8S- 75	52.34	2.7	black	average	oval	small	semi free	average	great	3.33

Table 14. The average testing group scores (1=worst, 5=best) given to the characteristics of the selections shown at the Dried Plum/Prune Testing Group meeting in December 2012, sorted by 'Total Rating'.

Sample Number	Item Name	Flavor	Skin Color	Skin Quality	Fruit Size	Pitting Quality	Flesh Color	Flesh Texture	Total Rating	Comments
4	G16N-19	4.3	3.9	3.8	4.5	2.7	3.9	3.9	27	sweet, great taste. Too sweet, semi free pit good flesh color
9	G40N-34	3.8	4.1	4.1	4.2	3.6	3.7	3.7	27	good eating quality, good taste tight, small pit
7	G39N-57	3.6	4	3.8	4.1	3.7	3.5	3.6	26.2	good, sweet flavor, black color, not fruity, semi free pit
12	H20S- 58	3.8	3.2	3.6	4.1	2.9	3.7	4.1	25.2	sweet, good flavor, nice light color solid flesh
11	G39N-34	3.5	3.8	3.6	4	3.3	3.8	3.7	24.8	unique flavor, tight skin, slightly tart, great taste
10	G36S- 57	3.8	3.4	3.3	4.3	2.5	4	3.6	24	good honey flavor, thin skin, excellent flesh, dull appearance
13	G47S-4	3.3	3.6	3.4	3.2	3.6	3.5	3.4	23.9	ok taste, large wrinkles, nice flesh
14	H8S-75	3.3	3.4	3.4	3.5	3.2	3.6	3.7	23.7	tart, good fresh plum taste, large pit good flesh
1	F11S-38	3	3.5	3.1	2.9	3.3	3.4	3.3	22.3	odd wrinkles, thick skin, off flavor, small pit
2	H7N-71	3.1	3.6	3.1	3.7	2.2	3.4	3.1	22.1	very good taste, large semi free pit, thick & meaty, fine wrinkles
5	G3N-16	2.6	3.3	3.4	3.3	2.8	2.7	3.3	21.2	bland taste, soft flesh, semi free pit
6	F11S-65	2.7	2.5	3.3	3.3	2.6	3.1	3.5	20.3	dull skin color, bland flavor, good flesh, large pit
8	G5N-35	2.8	3.1	3.1	2.6	2.7	2.9	3.1	20.1	small, ordinary, tough skin, chewy
3	Imp. French	1.9	2.9	2.7	3.1	2.2	2	2.4	17.2	large free pit, pit burr, dark tough, burnt flavor

DONATIONS

We would like to thank Duarte Nursery Inc, for the donation of nursery care of the program's seedlings. We would also like to thank Pacific Western Container for donating the tree protectors for the seedling plantings at Davis. Their generosity helps support UC research and the California dried plum industry's goal in developing new dried plum cultivars for California.